26 Extension Note

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Site Index Conversion Equations for Mixed Western Hemlock–Amabilis Fir Stands

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Abstract

Western hemlock–amabilis fir is a common species mixture on the coast of British Columbia. Model development and testing data sets containing site index pairs for hemlock–amabilis fir were compiled. Then, a site index conversion equation was developed and tested.

Introduction

Site index conversion equations allow the site index of one species to be estimated from the site index of another species when the two species are growing together in a mixed stand. Conversion equations are available for mixed western hemlock (*Tsuga heterophylla* [Raf.] Sarg.)–Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco var. *menziesii*) (Nigh 1995a) and western hemlock–Sitka spruce (*Picea sitchensis* [Bong.] Carr.) (Nigh 1995b) stands on the coast of British Columbia. Another common coastal species mixture is western hemlock–amabilis fir (*Abies amabilis* [Dougl.] Forbes). This extension note describes the development and testing of a site index conversion equation for this species mixture.

Data, Analysis, and Results

Forty-three 0.04-ha sample plots were established in mixed hemlock–amabilis fir stands.[1] Four sample trees of both species were selected and their breast height age and total height were recorded in accordance with provincial standards (Nigh et al. 1998). Increment cores were taken to determine ages and to detect suppression. Suppressed sample trees were deleted from the data set. Plots with more than one suppressed tree of one species were excluded from the analysis. The heights and ages were averaged by species within each plot (Figure 1).

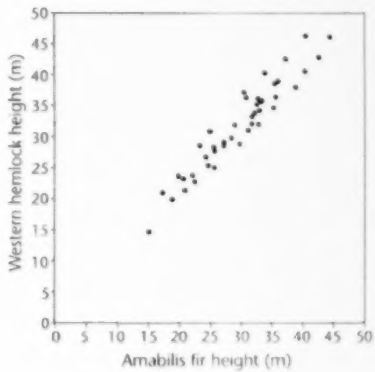

FIGURE 1 *Sample plot heights* (•).

1 Western Forest Products Ltd. collected the data

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TABLE 1 *Summary statistics for the model development and test data sets*

Data set type	Species	Site index (m) Mean	Standard deviation	Minimum	Maximum
Model building	Western hemlock	31.68	3.94	21.54	38.11
	Amabilis fir	29.26	3.88	19.54	37.70
Model testing	Western hemlock	27.81	6.04	12.53	36.90
	Amabilis fir	25.97	7.05	12.35	37.05

TABLE 2 *Results of the site index conversion equation analysis*

Conversion equation	b	m	Correlation coefficient
$SI_{Hw} = b + m \times SI_{Ba}$	2.005	1.014	0.863
$SI_{Ba} = b + m \times SI_{Hw}$	-1.977	0.9861	0.863

To test the conversion equations, a data set consisting of 42 hemlock–amabilis fir site index pairs was compiled from data collected on Tree Farm Licence 37 near Woss, B.C.[2] Each sample consists of the breast height age and height of one tree of each species.

The site indices for both the model development and test data were estimated from the height-age and, for trees under 30 years breast height age, from the growth intercept models recommended by the Ministry of Forests (Nussbaum 1996; Nigh 1997). Table 1 summarizes statistics for both data sets. The slope and intercept of the geometric mean regression (GMR) line (Nigh 1995c) and the correlation coefficient of the site index pairs were estimated from the model development data. The GMR line is

$$SI_i = b + m \times SI_j \qquad [1]$$

where: SI_i = the site index of species i (i = western hemlock or amabilis fir), b is the estimated intercept, m is the estimated slope, and SI_j is the site index of species j (j = amabilis fir or western hemlock). The fitted GMR line is the site index conversion equation. The results of the analysis are presented in Table 2. The site index pairs and the conversion equation are plotted in Figure 2.

The site index conversion equation was tested by using the test data to estimate the site index of species i from the site index of species j, and

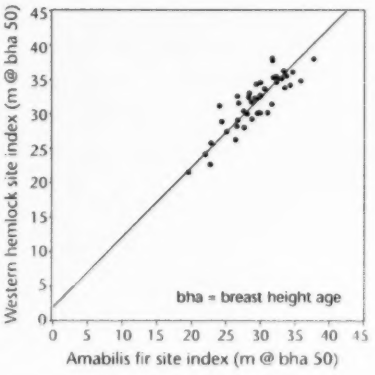

FIGURE 2 *Sample plot site indices (•) with the fitted site index conversion line (———).*

2 Canadian Forest Products Ltd. supplied the data.

TABLE 3 *Results of testing the conversion equations*

Conversion equation	Mean error (m)	Standard error (m)	*t*-statistic[a]	*p*-value
$SI_{Hw} = 2.005 + 1.014 \times SI_{Ba}$	-0.53	0.49	-1.07	0.29
$SI_{Ba} = -1.977 + 0.9861 \times SI_{Hw}$	0.52	0.49	1.08	0.29

a H_0: mean error = 0.

conversely. The mean error in each estimated site index was calculated and tested for a statistically significant difference from zero. Table 3 shows the results of testing the conversion equation. Also, the site index pairs and the conversion equation are plotted in Figure 3.

Discussion

A new site index conversion equation was developed:

$$SI_{Hw} = 2.005 + 1.014 \times SI_{Ba}; \qquad [2]$$

This equation can be inverted to convert a western hemlock site index into an amabilis fir site index.

A comparison of the western hemlock and amabilis fir heights shows that the hemlock trees are slightly taller than the fir trees (Figure 1). However, the heights are close and the relationship between the heights of the two species is consistent. Suppression is unlikely to be occurring in the hemlock–amabilis fir plots, and would therefore not bias the results. The testing indicates that the site index conversion equation for western hemlock–amabilis fir is suitable (Table 3; Figure 3).

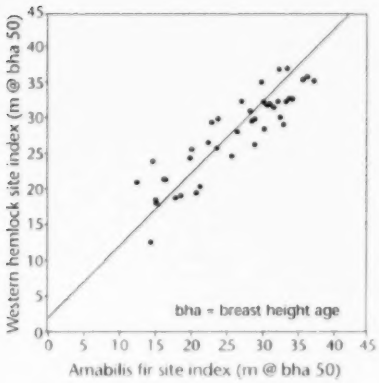

FIGURE 3 *Sample plot site indices (•) from the test data set with the fitted site index conversion line (———).*

Conclusion

A site index conversion equation was developed for western hemlock–amabilis fir stands, a common coastal British Columbia species mixture. This equation allows the site index of one species to be estimated from the site index of the other species.

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